MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3153a
MSDS Number: 3153a
SRM Name: Strontium Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Strontium Standard Solution

Description: SRM 3153a is a single element solution prepared gravimetrically to contain a nominal 10 mg/g of strontium with a nitric acid volume fraction of 10 %.

Other Designations: **Strontium** (strontium metal) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid); **Strontium Nitrate*** (nitric acid strontium salt; strontium (II) nitrate) in **Standard Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO_3	7697-37-2
Strontium Nitrate	$Sr(NO_3)_2$	10042-76-9
Strontium	Sr	7440-24-6

DOT Classification: Nitric Acid, Solution, UN2031

Manufacturer/Supplier: It is available from a number of suppliers.

*The addition of strontium to nitric acid, along with other intermediate chemical reactions, forms strontium nitrate which will precipitate upon evaporation or drying of the solution.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentrations (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	ACGIH TLV-TWA: 2 ppm or 5 mg/m^3
		OSHA TLV-STEL: 4 ppm or 10 mg/m^3
		Human, Oral: LD_{LO}: 430 mg/kg
Strontium Nitrate	2.4	No TLV-TWA established*
		Rat, Oral: LD_{50}: 27500 mg/kg
		Rat, Intraperitoneal: LD_{50}: 540 mg/kg
		Mouse, Oral: LD_{50}: 1826 mg/kg
Strontium	1.0	No TLV-TWA established*

*The suggested ACGIH TLV-TWA for particulates not otherwise regulated is 10 mg/m^3 for total dust.

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Strontium Nitrate	Strontium
Appearance and Odor: a white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; pungent odor	**Appearance and Odor:** a colorless or white crystalline powder	**Appearance and Odor:** a silvery white metal
Relative Molecular Mass: 63.02	**Relative Molecular Weight:** 211.63	**Relative Atomic Mass:** 87.62
Density: 1.0543 (10 % nitric acid)	**Density:** 2.986	**Density:** 2.6
Solubility in Water: soluble	**Solubility in Water:** soluble	**Solubility in Water:** reacts with water
Solvent Solubility: decomposes in alcohol	**Solvent Solubility:** very soluble in liquid ammonia	**Solvent Solubility:** soluble in dilute acids

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this strontium/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A **Method Used:** N/A **Autoignition Temperature:** N/A

Flammability Limits in Air (Volume %): **UPPER:** N/A
LOWER: N/A

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Strontium may ignite spontaneously in air.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: **__X__ Stable** **____ Unstable**

Conditions to Avoid: Avoid contact with incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid away from organic materials, plastics, rubber and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide. Strontium should be kept from strong oxidizers.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or strontium nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), as well as nitric acid mist or vapor. Thermal decomposition of strontium nitrate may include toxic oxides of nitrogen; thermal decomposition of strontium may release toxic and/or hazardous gases.

Hazardous Polymerization: **_____ Will Occur** **__X__ Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X **Inhalation** X **Skin** X **Ingestion**

Health Hazards (Acute and Chronic): Nitric Acid: Nitric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Strontium and Strontium Nitrate: Inhalation of strontium and strontium nitrate produces slight irritation of the mucous membranes. Skin contact with these materials causes irritation; repeated contact causes dermatitis. Ingestion of large doses of strontium and strontium salts may cause vomiting, diarrhea, and painful contractions of the limbs. Other symptoms of ingestion may include cyanosis, headache, weakness, dizziness, lightheadedness, loss of muscle coordination, shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy, stupor, and convulsions. Repeated or prolonged exposure to nitrates may cause anemia and inflammation of the kidneys.

Medical Conditions Generally Aggravated by Exposure: Nitric Acid: eye disorders, skin disorders, respiratory disorders, and allergies

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. If the exposed person is responsive, give one or two glasses of milk or water to drink. Obtain medical assistance immediately.

NOTE TO PHYSICIAN (Nitric Acid): Wash affected skin areas with 5 % solution of sodium bicarbonate ($NaHCO_3$). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK:
Nitric Acid: skin, teeth, eyes, and upper respiratory tract
Strontium Nitrate: liver, kidneys, heart, lungs, and spleen
Strontium: cardiovascular and respiratory systems

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: The nitrogen oxides produced from the acid are all toxic; nitric acid itself is corrosive. Neoprene gloves and body shields should be used where splashing may occur. Chemical safety showers and eyewash stations must be readily available. Workers must receive training before handling nitric acid in the workplace.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store this material at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources:
MDL, MSDS *Strontium Nitrate*, September 10, 1998.
MDL, MSDS *Strontium*, March 16, 1999.
MDL, MSDS *Nitric Acid*, June 2, 1999.
The Merck Index, 11th Ed., 1989.
Sigma-Aldrich Library of Chemical Safety Date, Ed. II, 1988.